

sPHENIX Calorimeter Electronics Integration and Prototyping

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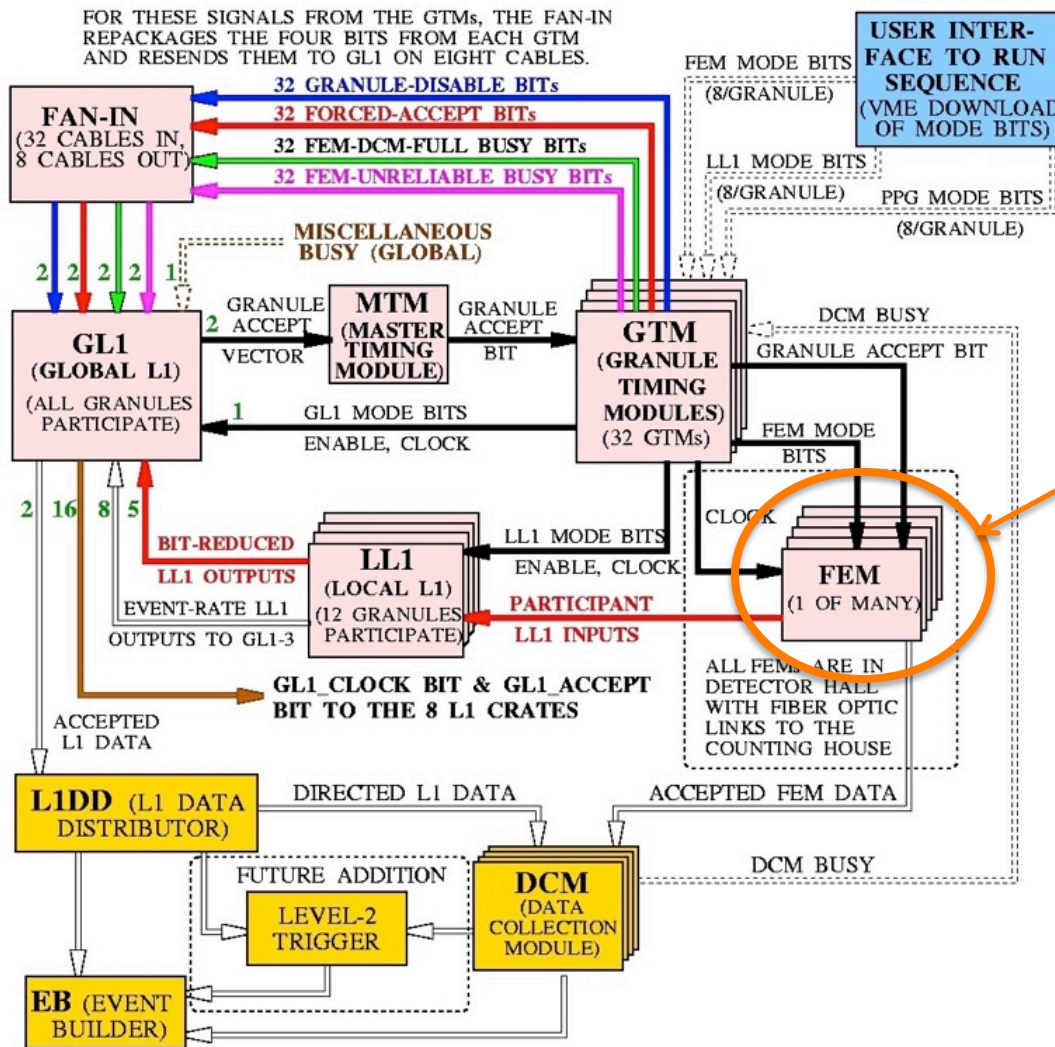


Integration

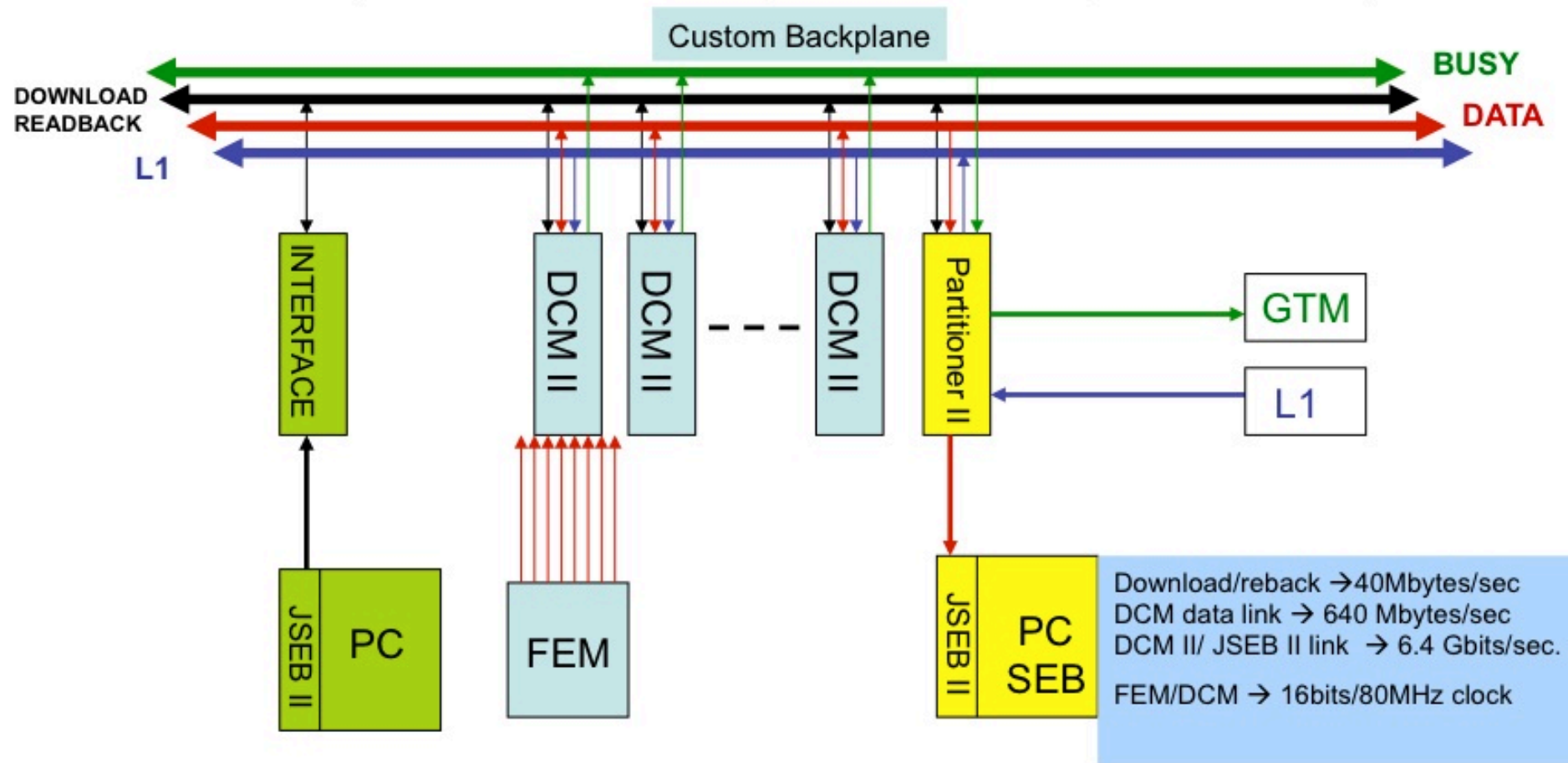
The sPHENIX concept was to reuse as much as possible the parts of PHENIX electronics, data acquisition, slow controls, and safety systems

- Level 1 trigger
 - GL1 provides coordination among granules and busy logic
 - LL1's perform trigger calculation
- Timing system provides clocks and L1 Accept to systems
- DCM2 system receives raw data from detectors (generally not zero suppressed) via 2 Gbps optical links
- Event builder consists of
 - SEB (sub event buffer) front end with interface card to receive event fragments from DCM system
 - ATP (assembly and trigger processor) system after gigabit network switch builds complete events in memory
- Buffer box system writes data to RAID disk
- 10 Gbps links to RACF bring data to HPSS
- Advantech ADAM OPC system

LEGEND:  FILLED ARROWS FOR DATA TRANSFER AT BEAM CROSSING RATE
 EMPTY ARROWS FOR DATA TRANSFER AT ACCEPTED EVENT RATE
 DASHED ARROWS FOR DATA TRANSFER AT ASYNCHRONOUS RATE



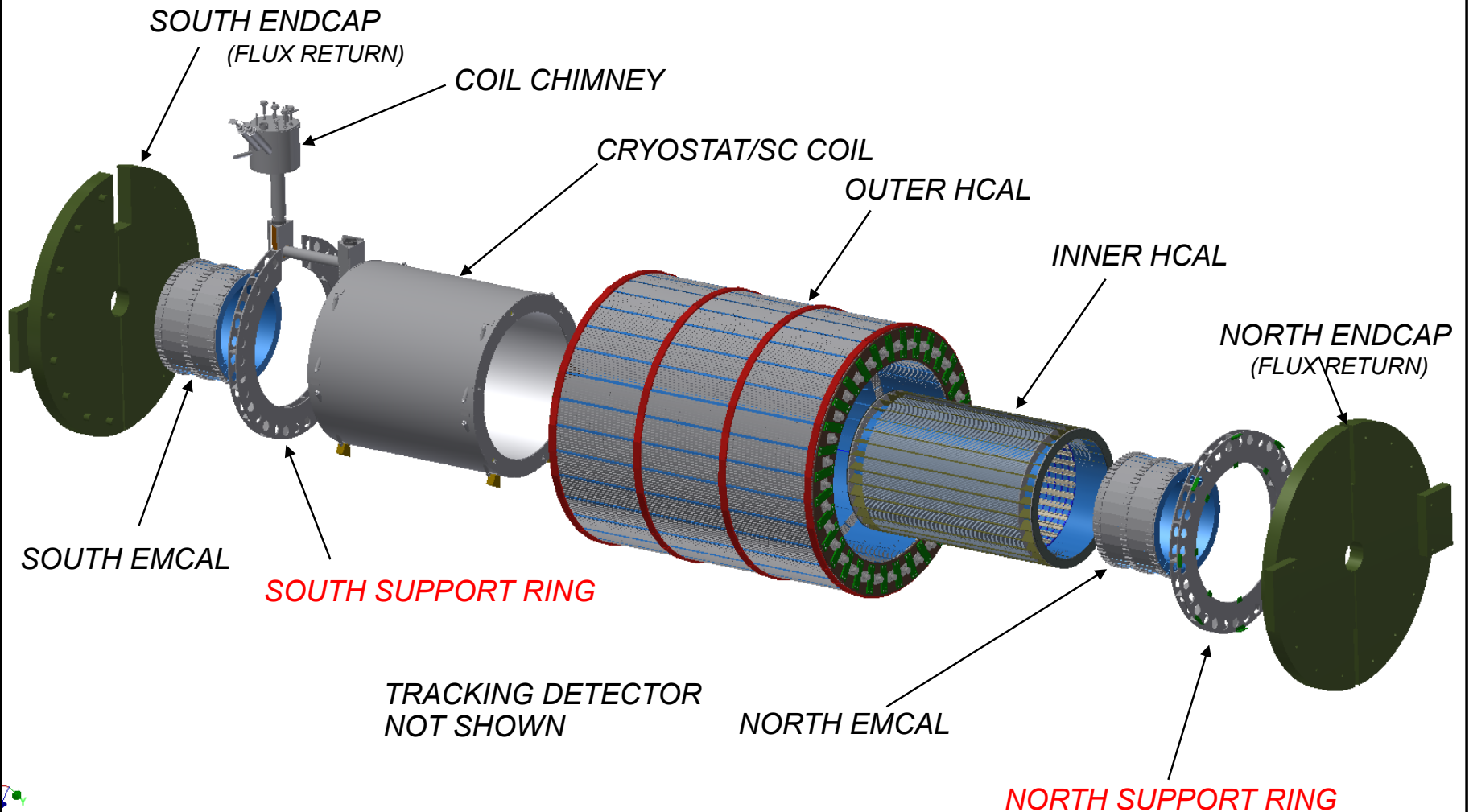
DCM II system diagram



Integrating into DAQ and control system

- The 24 ADC crates would be read out with 96 fibers or 12 DCM2 modules, a very modest expansion
- EMCAL, IHCAL, and OHCAL are only 3 granules (sharing clock and Level 1 Accept)
- EMCAL and HCAL require only of order 10 racks in the IR

SPHENIX EXPLODED VIEW

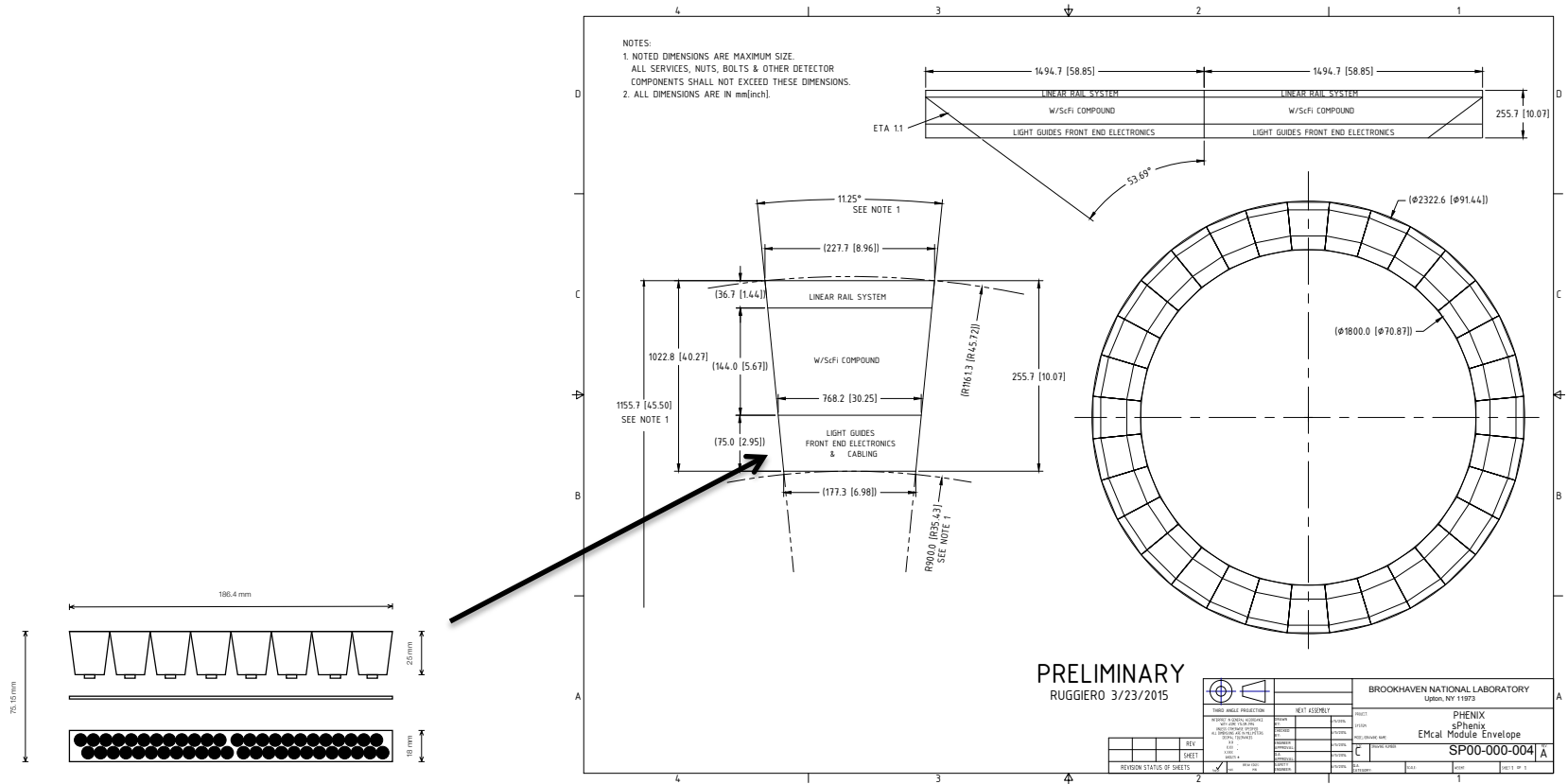


2/23/2015

Analog cables

- We are working on routing the analog cables out the ends to the ADC racks along with bias and LV for the preamps
- Cables routed to both ends
- The 32 EMCAL sectors have 384 analog signals on each end (24 16 channel cables)
- Light-tight plenum can provide cable management and cooling path
- We are developing details with the help of an engineer in CAD

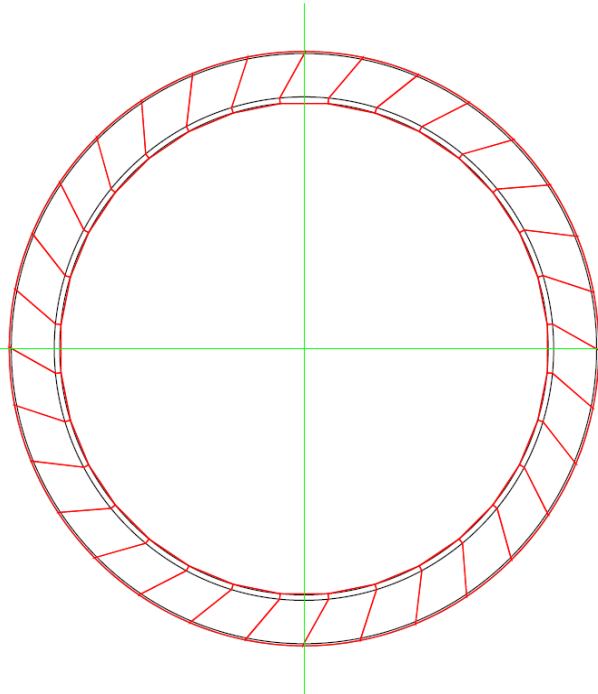
EMCAL cabling



January 5, 2015



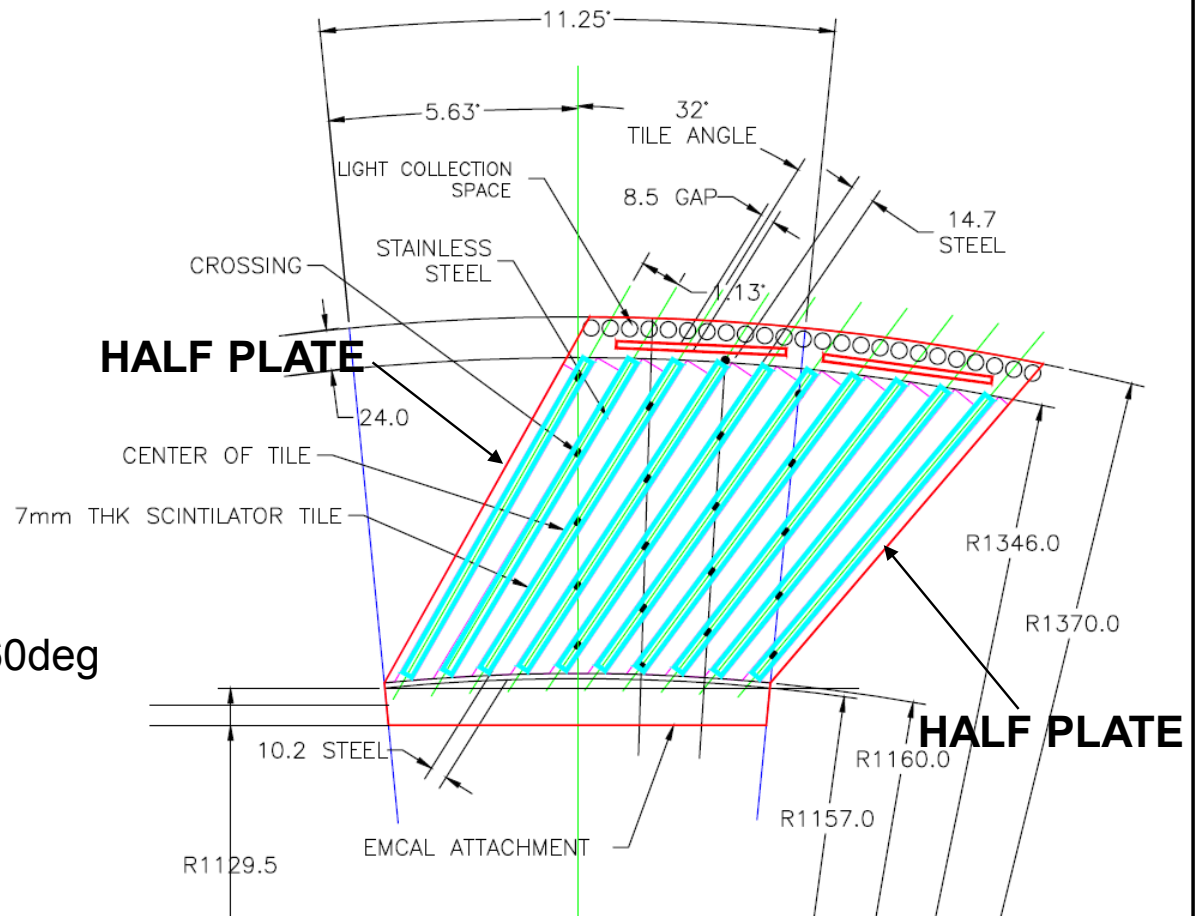
INNER HCAL GEOMETRY



32 MODULES COVERING 360deg

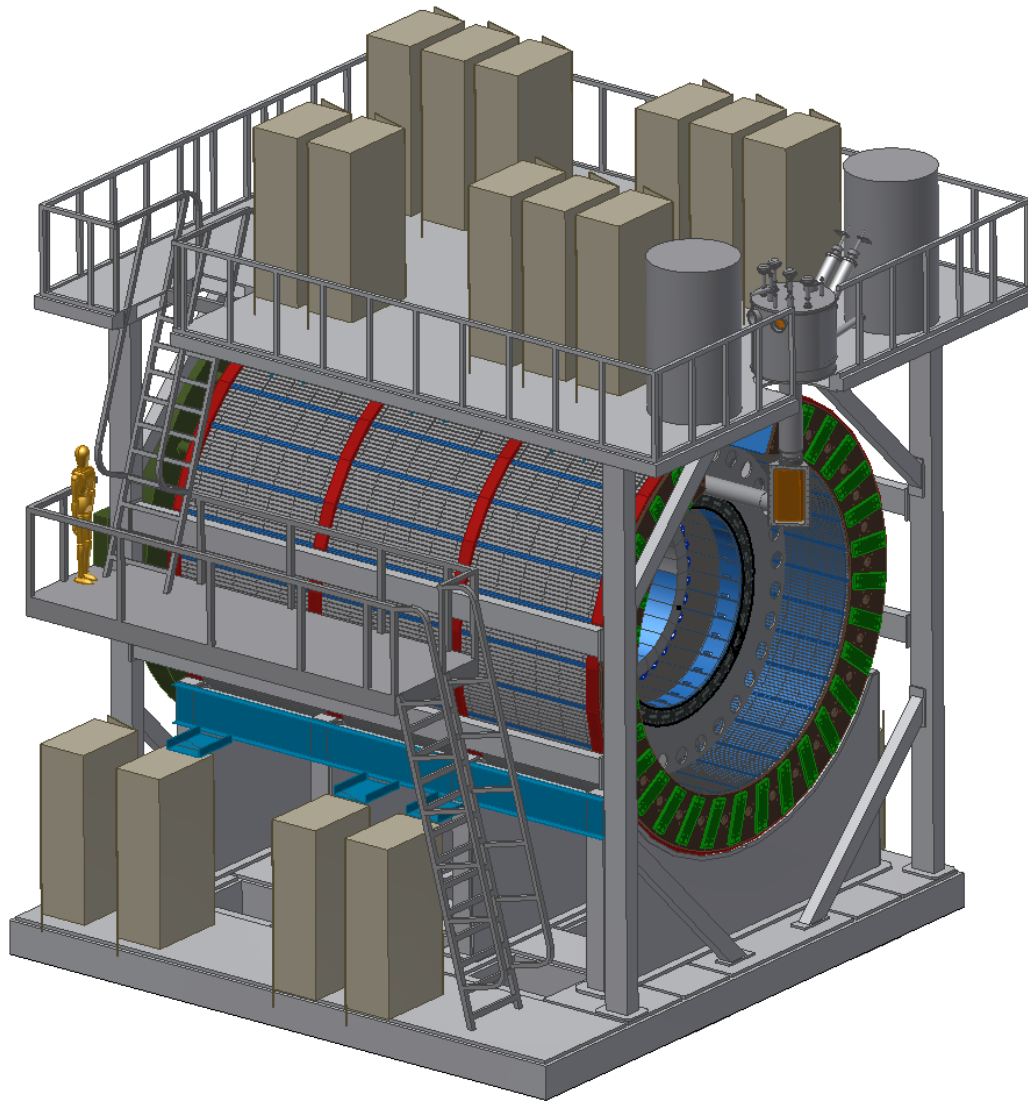
INNER RADIUS ENVELOPE -1.16m
OUTER RADIUS ENVELOPE - 1.37m

10 ROWS of 7mm Scint Tiles
22 Tiles in each row.
32deg Tilt Angle
~10.2mm – ~14.7mm Tapered SST 304 Plates



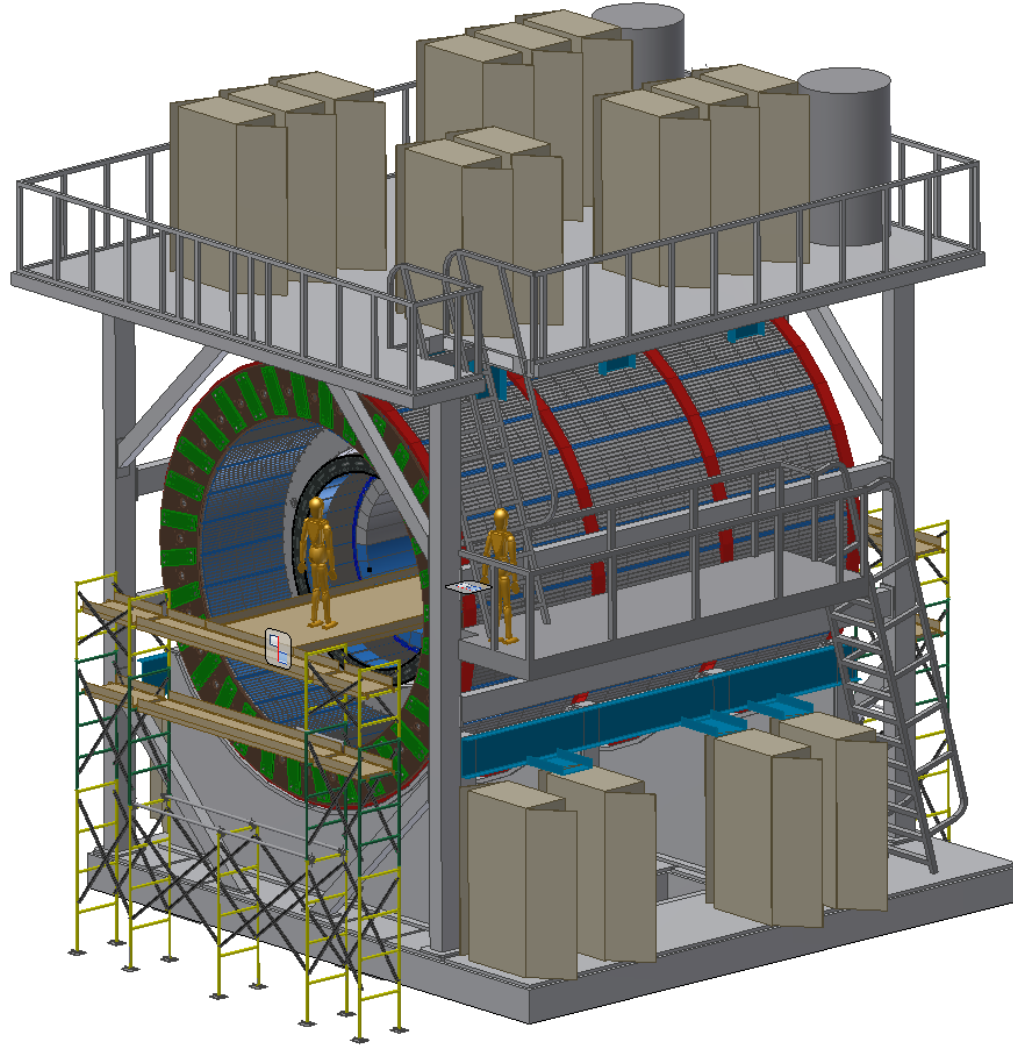
Access and serviceability

- We are thinking through the access and scaffolding needs for electronics, but they are similar to PHENIX
- The on-detector electronics is largely inaccessible during a run (not unlike many PHENIX systems) which is what drove us to keep it simple
- ADC, bias, and low voltage electronics in easily accessible racks



January 5, 2015



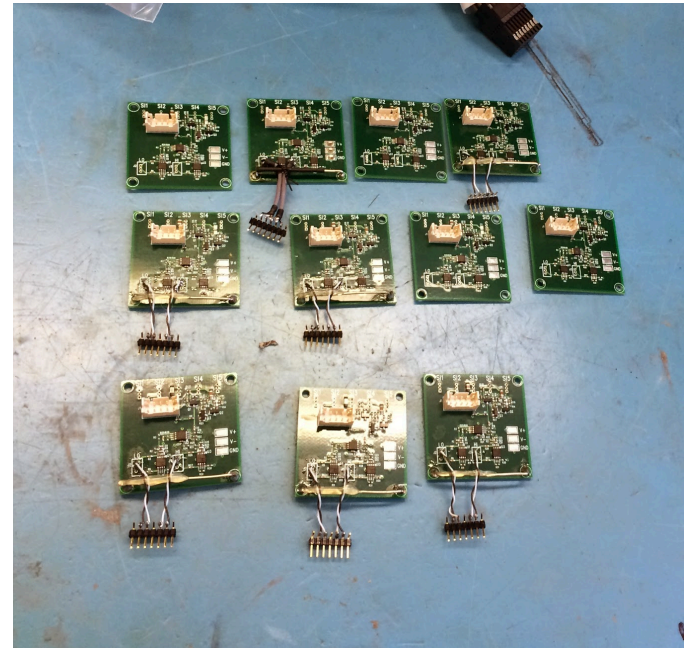
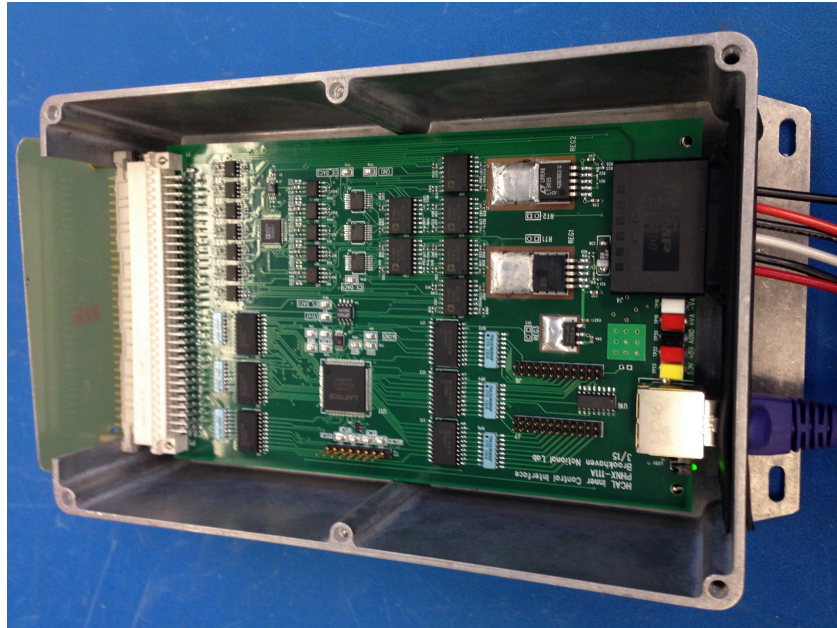


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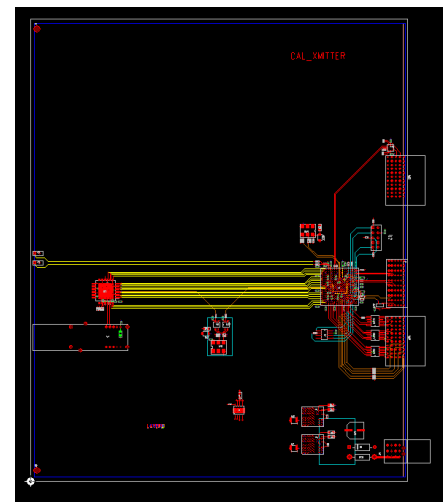
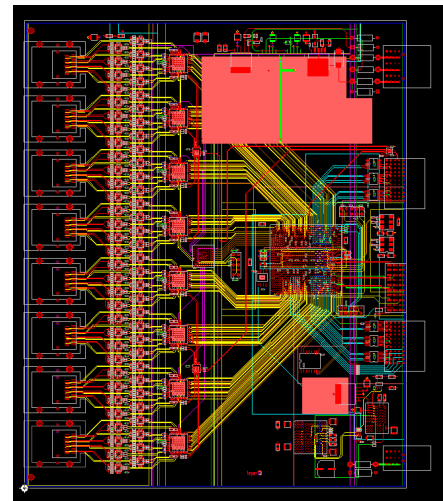
Calorimeter electronics prototypes

- Steve has developed a the next preamp and controller



Data acquisition and triggering development

- Chi and Bill have described the first cut at the ADC, XMIT, and backplane
- Should be ready for deployment in tests in 2016

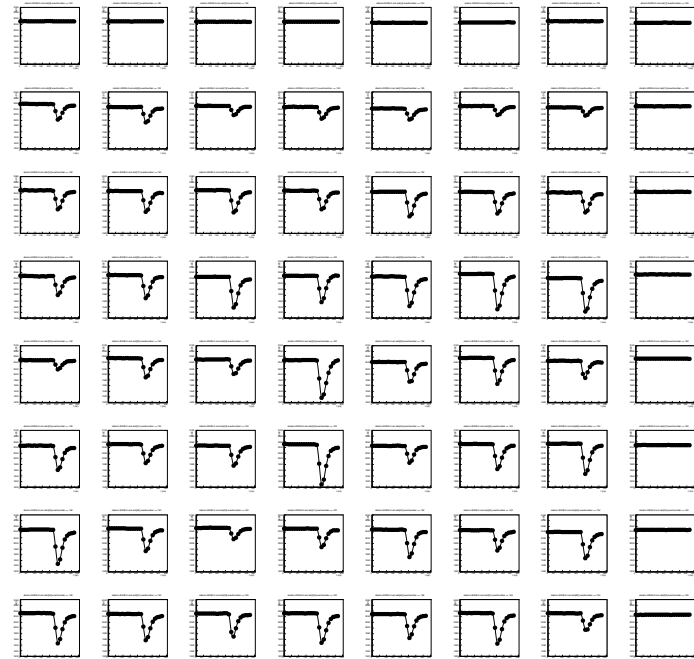


Prototypes

- Zeroth generation amplifiers and digitizers were used at Fermilab Test Beam Facility in T-1044 (February 2014)
- Radiation damage tests in PHENIX runs 14 and 15 and others shown by Sean
- New tiles from Uniplast arriving in a few weeks will allow source and cosmic ray testing with our current electronics

T-1044

EMCAL HCAL



Calorimeters at FTBF

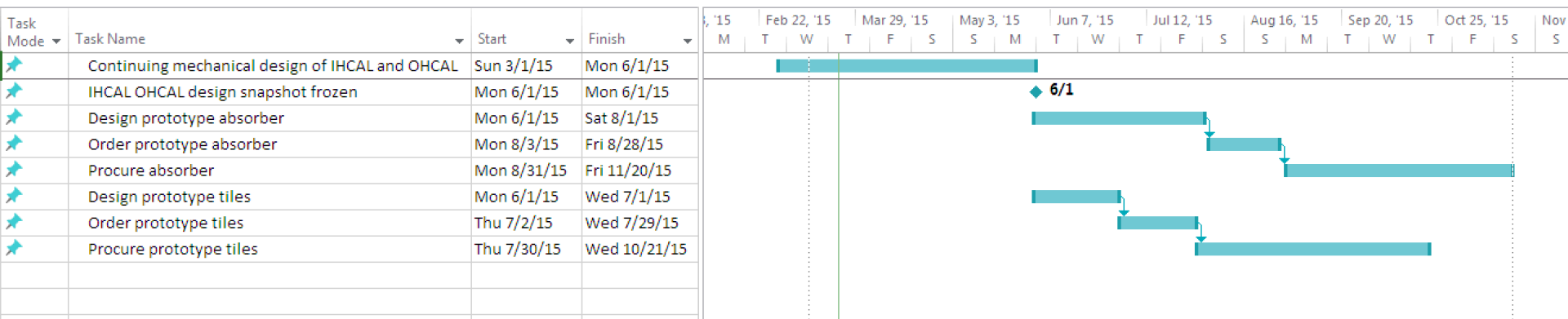
LED pulses from 7x7 EMCAL

Next steps

- We are developing a plan for a second round of prototypes which we hope to make as close as possible to the final sPHENIX design
- The goal is to be prepared for a second beam test at Fermilab with the 3 calorimeters in April 2016 with an option for a second round test a few months later
- The mechanical design is progressing toward a point where we should be able to design a prototype from a snapshot
- We hope to be able to test new Nevis ADC system, but we could live with the HBD electronics if need be

Next prototypes

- Electronic development should be aimed to produce enough channels to test the HCAL and EMCAL systems at BNL in January 2016 before shipping to FTBF
- Channel count is again quite modest (5x5 HCAL's, 8x8 EMCAL)



Issues and concerns

- Mechanical and electronic designs are converging, but we particularly need to complete the mechanical design of the projective EMCAL
- We need to settle on a calibration system
- Need to finalize gains to be consistent with achievable light output
- Need to make sure there is adequate commissioning time in the schedule to allow burn-in before installation